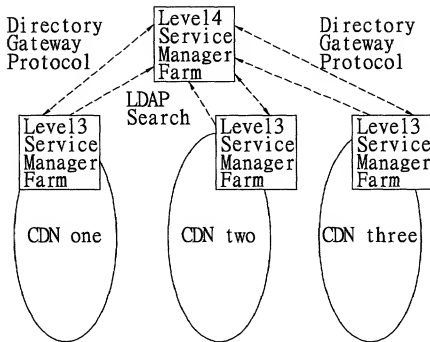


#4

FIG. 1

Content Peering for Multiple CDN Networks



Although it depends on directory information forwarding policy, typically

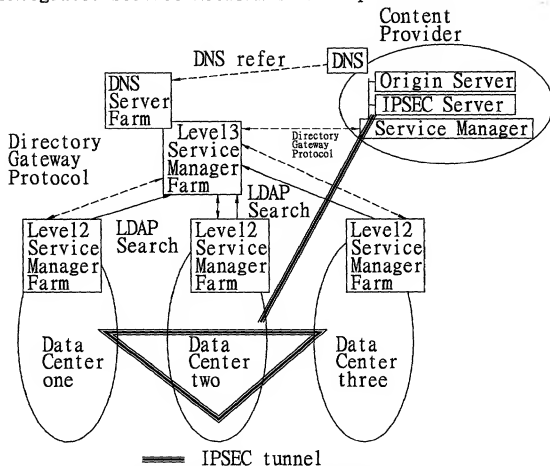
Level4 Service Manager stores the content location information of CDN one, CDN two and CDN three.

Level3 Service Manager of CDN one stores only the content location information of CDN one.

Level3 Service Manager of CDN two stores only the content location information of CDN two.

Level3 Service Manager of CDN three stores only the content location information of CDN three.

FIG. 2a
Integrated Service Network of Multiple Data Centers



Although it depends on directory information forwarding policy, typically

Level3 Service Manager stores the content location information of Data Center one, Data Center two and Data Center three.

Level2 Service Manager of Data Center one stores only the content location information of Data Center one.

Level2 Service Manager of Data Center two stores only the content location information of Data Center two.

Level2 Service Manager of Data Center three stores only the content location information of Data Center three.

Data going across Data Center can go through IPSEC tunnel to guarantee privacy and security or even form a VPN among Data Centers.

FIG. 2b
Integrated Service Network of Multiple Data Centers

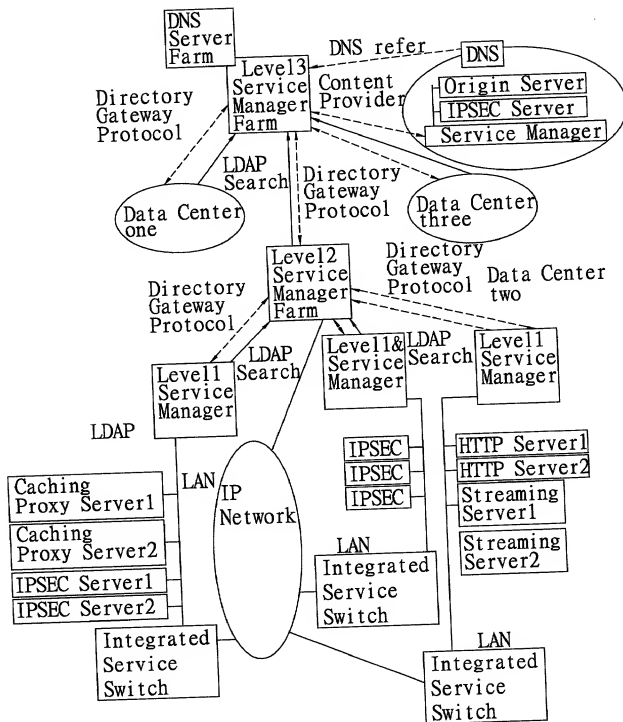


FIG. 3

Service Manager and Caching Proxy Server Farm in a Data Center

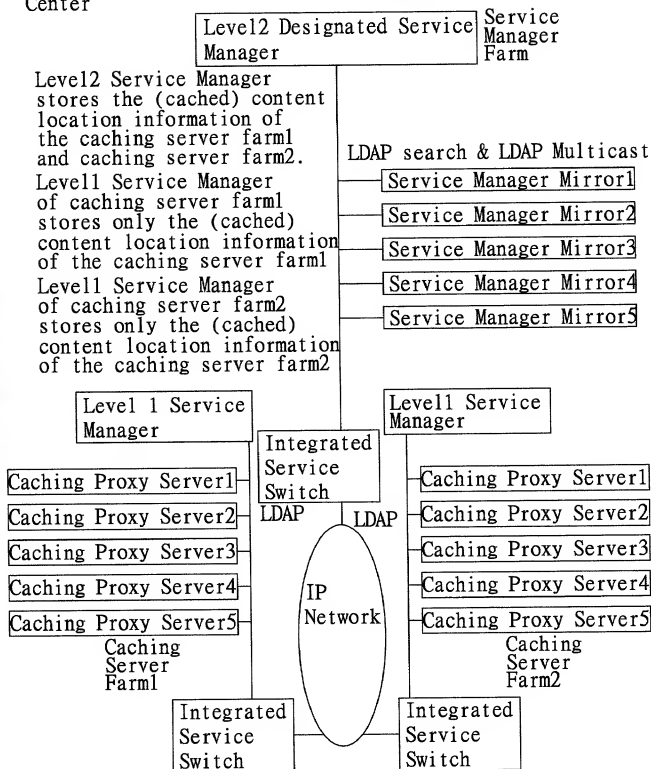


FIG. 4

Directory information Multicast Update in Service Manager Farm

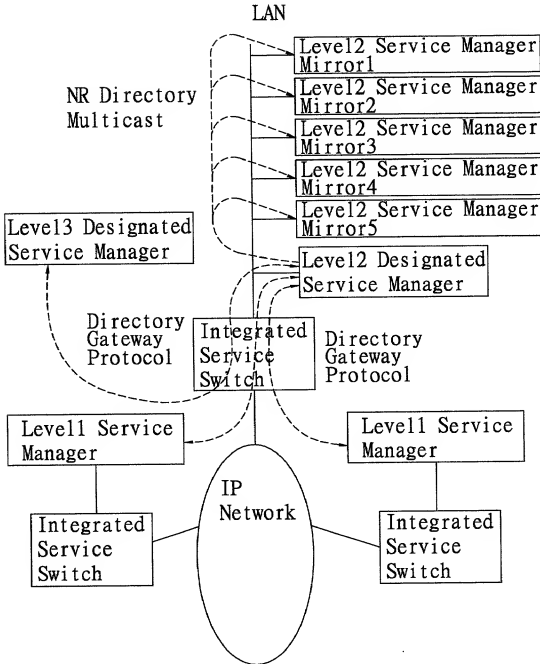


FIG. 5

Integrated Service LAN

SE:Service Engine

ISS:Integrated Service Switch

SM:Service Manager(Level 1)

BSM:Backup Service Manager(Level 1)

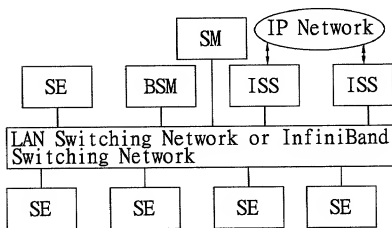


FIG. 5

Reliable Multicast Transport Protocol Sequence

SM:Service Manager

SE:Service Engine

Transport
Sender

Transport
Sender

```

Transport multicast syn(seq n,init,more)
Transport acknowledge(seq n,init,more,SE1)
Transport acknowledge(seq n,init,more,SE2)
...
(Wait a while to see any re-send request by any SE)
(IF no re-send request,then acknowledge by SM)
(IF it does have re-send request or missing
acknowledge by any SE, then SM won't acknowledge
and sender will resend the syn packet again)
Transport acknowledge (seq n,init,more>window i,SM)
Transport multicast update(seq n+1)
...
Transport multicast update(seq n+1)
(Wait a while to see any re-send request by any SE)
(IF no re-send request,then acknowledge by SM)
(IF it does have re-send request,then sender
resends the packets in the current window)
(← re-send request)
Transport acknowledge(seq n+i>window j)
Transport multicast update (seq n+i+1)
Transport multicast update (seq n+i+2)
...
Transport multicast update (seq n+i+k,last)
  
```

Transport acknowledge(seq n+i+k, last by SE1)

Transport acknowledge(seq n+i+k, last by SE2)

...

Transport acknowledge(seq n+i+k, last by SM)

Note that acknowledge and re-send request are both multicast packets.

FIG. 6
Transport multicast about operation Sequence

Transport multicast about(seq n+i+k,last)
Transport acknowledge(seq n+i+k,last by SE1)
Transport acknowledge(seq n+i+k,last by SE2)
 ...
Transport acknowledge(seq n+i+k,last by SM)

This about operation allow sender to about the multicast operation for whatever reason,it can send a Transport multicast about message and should acknowledge by all others and SM.SM will acknowledge until all others have acknowledged.

FIG. 7
Reliable Multicast Directory Update Protocol Sequence

Directory
Information
Sender

Directory
Information
Recipient

LDAP_MULTICAST_OP is one of the following operations:

LDAP_ADD,
 LDAP_DELETE,
 LDAP_MODIFY_ADD,
 LDAP_MODIFY_REPLACE,
 LDAP_MODIFY_DELETE

LDAP_OP multicast(seq n,init,more)

...

LDAP_OP multicast(seq n+i,last)

FIG. 8
Reliable Multicast Management Protocol Sequence

SNMP
Manager

SNMP
Agent

SNMP_MULTICAST_OP is one of the following operations:

SNMP_GET,
SNMP_GETNEXT,
SNMP_SET

SNMP_MULTICAST_OP multicast(seq n,init,no more)
